MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2018/2019

PPS0034 – INTRODUCTION TO PROBABILITY AND STATISTICS

(Foundation in Business)

26 OCTOBER 2018
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 4 pages with **FOUR** questions.

2. Attempt **ALL** four questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the answer booklet provided. All necessary workings **MUST** be shown.

4. **Formulae** are provided at the back of the question paper.

5. **Statistical table** is provided.

Question 1

a) The discrete random variable X can take only the values 0, 1 and 2. For these values, the **cumulative distribution function, $F(X)$** is defined by

$$F(x) = \begin{cases} \dfrac{x^3 + m}{50} & x = 0,1,2 \end{cases}$$

i) Show that $m = 42$. (2 marks)
ii) Construct the **probability distribution of X, $P(X)$.** (5 marks)
iii) Find the expected value and variance for the random variable X. (6 marks)

b) The continuous random variable Y has the following probability density function:

$$f(y) = \begin{cases} \dfrac{1}{9}\left(y^2 - 2y + 2\right) & ; \quad 0 \le y < 3 \\ \dfrac{1}{3} & ; \quad 3 \le y \le 4 \\ 0 & ; \quad \text{otherwise} \end{cases}$$

i) Evaluate $P(2 \le Y \le 4)$. (4 marks)
ii) Show that $E(Y) = \dfrac{29}{12}$. (4 marks)
iii) Find the variance for the random variable Y. (4 marks)

(Total = 25 marks)

Question 2

a) Let's say that 86% of all business startups in the IT industry report that they generate a profit in their first year. If a sample of 17 new IT business startups is selected, find the probability that
i) more than 13 will generate a profit in their first year. (3 marks)
ii) between 11 and 15 will generate a profit in their first year. (4 marks)

b) Patients arrive at a hospital emergency department at random at a rate of 7 per hour.
i) Find the probability that, during any 90 minute period, the number of patients arriving at the hospital emergency department is exactly 9. (3 marks)
ii) A patient arrives at 11.30am, find the probability that the next patient arrives before 11.45am. (3 marks)

c) The weight, in grams, of corns in a tin is normally distributed with a mean of 210 and a standard deviation of 7.8.
i) Given that 10% of tins contain less than w grams. Find the value of w. (Leave your answer in 4 decimal places.) (4 marks)
ii) Find the percentage of tins that contain more than 232g of corns. (3 marks)

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iii) The machine settings are adjusted so that the weight, in grams, of corns in a tin is normally distributed with a mean of 205 and a standard deviation of σ. Given that 98% of tins contain between 200g and 210g of corns, find the value of σ. (Leave your answer in 4 decimal places.) (5marks)

(Total = 25 marks)

Question 3

a) Consider the following data on the working hours per day for all part time workers in a shopping complex:

8 6 8 12 4 12

i) List all the possible samples of size five (without replacement) from this population and construct the sampling distribution of the sample mean. Then, find the sampling error for each sample. (15 marks)

ii) If a random sample of 5 members : 6, 8, 12, 4, 12 was mistakenly recorded as 6, 8, 12, 14, 12, calculate the non-sampling error. (3 marks)

b) Suppose the mean weight of school children's bags is 17.8 pounds, with a standard deviation of 2.4 pounds.

i) What is the mean, and the standard deviation of the sample mean of 36 randomly selected bags? (3 marks)

ii) Find the probability that the mean weight of a sample of 36 bags will exceed 18.5 pounds. (4 marks)

(Total = 25 marks)

Question 4

a) A biologist was interested in determining whether sunflower seedlings treated with an extract from *Vinca minor* roots resulted in a lower average height of sunflower seedlings than the standard deviation of 15.4 cm. The biologist treated a random sample of $n = 36$ seedlings with the extract and subsequently obtained the following heights:

15.2	19.0	12.8	12.4	19.2	13.5
16.5	13.5	14.4	16.7	10.9	13.0
15.1	17.1	13.3	12.4	8.5	14.3
12.9	11.1	15.0	13.3	15.8	13.5
9.3	12.2	10.3	13.5	14.9	15.2
11.5	11.8	15.7	16.1	14.1	10.5

Assume that the population variance is 5.8545 cm.

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i) Construct a 96% confidence interval for the mean height of all such sunflower seedlings, based on a sample of 36 seedlings selected. (7 marks)

ii) Is there sufficient evidence, at the $\alpha = 0.002$ level, to conclude that the mean height of all such sunflower seedlings is less than 15.4 cm? (9 marks)

b) Suppose we want to show that children have an average higher cholesterol level than the national average. It is known that the mean cholesterol level for all Malaysians is 191.5. One hundred children were tested and found that the sample mean was 197 with a population standard deviation of 15. Can we suggest that the children have an average higher cholesterol level than the national average at a 0.01% significance level? (9 marks)

(Leave all your answers in at least 3 decimal places.)

(Total = 25 marks)

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Formulae:

1.

	Mean	Variance
Discrete Random Variable X	$\mu = E(X)$ $= \sum xP(x)$	$Var(X) = E(X^2) - [E(X)]^2$ **where** $E(X^2) = \sum x^2 P(x)$
Continuous Random Variable X	$\mu = E(X)$ $= \int_{-\infty}^{\infty} xf(x)dx$	$Var(X) = E(X^2) - [E(X)]^2$ **where** $E(X^2) = \int_{-\infty}^{\infty} x^2 f(x)dx$

2.

	Formula	Mean	Standard Deviation
Binomial Probability	$P(x) = \binom{n}{x} p^x q^{n-x}$	$\mu = np$	$\sigma = \sqrt{npq}$
Poisson Probability	$P(x) = \frac{e^{-\lambda}\lambda^x}{x!}$	$\mu = \lambda$	$\sigma = \sqrt{\lambda}$

3. The z value for a value of x: $z = \frac{x - \mu}{\sigma}$

4. The z value for a value of $\bar{x}$: $z = \frac{\bar{x} - \mu_{\bar{x}}}{\sigma_{\bar{x}}}$

where $\mu_{\bar{x}} = \mu$ and $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$

5. Sampling error = $\bar{x} - \mu$

Non-sampling error = incorrect $\bar{x}$ − correct $\bar{x}$

6. Point estimate of $\mu = \bar{x}$

Margin of error = $\pm 1.96\sigma_{\bar{x}} = \pm 1.96\frac{\sigma}{\sqrt{n}}$ or $= \pm 1.96 s_{\bar{x}} = \pm 1.96\frac{s}{\sqrt{n}}$

7. The $(1-\alpha)100\%$ confidence interval for μ is

$\bar{x} \pm z\sigma_{\bar{x}}$ if σ is known

$\bar{x} \pm z s_{\bar{x}}$ if σ is not known

where $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$ & $s_{\bar{x}} = \frac{s}{\sqrt{n}}$

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